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# Proportional-Time Infrared-Lamp Controller for Brooders

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A method of temperature control of infrared lamps for use in poultry brooders utilizing a proportional time-temperature controller has been developed. A public patent, No. 2,702,843, has been received on the basic control device which turns the lamps on and off for various intervals of a fixed time cycle, according to temperature.

An example of how this controller may be used, follows. Assume a minimum indoor ambient temperature, for example 34°F., with enough infrared lamps to maintain chick comfort for day-old chicks at this temperature. At 94°F. no heat will be required as this is the recommended ambient temperature for day-old chicks, so the control device should turn all lamps off. Now the controller should work between these limits of no heat, when the ambient temperature is 94°F., and full heat, at 34°F. At 64°F. (assuming chick heat requirements vary linearily, inversely proportional to temperature) 50 percent heat is required. Let us assume the temperature controller has a fixed time cycle of 60 seconds. When full heat is required (34°F.) the lamps are on for the entire full 60 seconds, at 94°F. they are off for the full cycle; and at 64°F. they are on for 30 seconds and off for 30 seconds. Similarly, for any intermediate temperature between the limits of 34°F. and 94°F. the lamps are on one second more and off one second less of the 60-second cylce for each degree below 94°F.; for example, at 84°F. the lamps would be on for 10 seconds and off for 50 seconds, at 44°F. the lamps would be on for 50 seconds and off for 10 seconds.

As the chicks grow older the top temperature limit may be lowered; for example, when the chicks are 1 week old the thermostat may be adjusted to turn the lamps off completely at 90-92°F., and with the same 60° temperature span they would be on continuously at 28°F.

The advantages claimed for this method of temperature control are as follows:

1. A fully modulated, continuous, control system is achieved for maximum chick comfort and operating economy at all ambient temperatures.

2. The controller is a simple, easily made device, requiring only the addition of an inexpensive timing motor, cam and follower to almost any basic type of temperature controller.

3. The radiant energy distribution pattern of the infrared lamp brooders is not disturbed.

4. Lamps are operated at line voltage, thus achieving a higher efficiency than is possible with systems that control lamp output by reducing the lamp voltage.

5. The controller may used for a single lamp or for multiple brooder installations. Relay contactors may be required for multiple lamp operation.

6. All lamps may be wired in parallel on one circuit, for minimum wiring costs, if desired.

7. "Stampeding" due to power outages do not occur because the chicks quickly become accustomed to periods of darkness.

In multiple brooder installations it would be advisable to have the lamps balanced between two circuits. Both circuits could be operated simultaneously from one controller, or better, one controller could be used which would control the two circuits, time displaced one-half cycle.

## METHOD OF OPERATION

Temperature-modulated time-cycle control is achieved, basically by adding to a conventional thermostat-switch arrangement, a fixed, cycling, mechanical displacement between the thermal sensing element and the actuating plunger of the switch.

One such arrangement is shown in Figure 1. A small electrical timing motor (E) displaces the switch (A) vertically, in relation to the thermal sensing element (J) through a cam (F) attached to the motor, and a follower (G) attached to the switch pivoted at (D).

If, for example, the switch is to be used to control heating, normally closed contacts are used on the switch. While the switch plunger (B) is held by the cam above the thermally-moved plunger (J) the switch contacts are closed. As the thermal plunger raises due to heating, contact will be made with the switch plunger and the switch contacts will open. The duration of the switch contacts remaining open will depend upon the position of the thermal element and the displacement and speed of rotation of the cam. As the thermal plunger continues to rise the amount of time the contacts are closed will become smaller and smaller, until finally the thermal plunger will lift the switch so high that contact cannot be made between the cam follower and cam, and the heat will be off continuously.

The displacement-temperature relationship of the thermostat and the displacement-angle relationship of the cam will determine the overall time-on versus temperature characteristic of the controller. They may be made linear or non-linear, as desired.

The length of the time cycle must be a compromise between a maximum dictated by the thermal storage capacity of the chick and between a minimum

dictated by mechanical fatigue of the switching elements. A 60-second cycle has been successfully used controlling all lamps without even a pilot lamp operating during the off period. Since near-maximum heat is usually required during the initial brooding period the off periods are relatively short as compared with the on periods and the chicks quickly become accustomed to the on-off method of control.

An adjustment screw (K) at the bottom of the thermal sensing unit moves the thermal plunger up and down and determines the thermostat setting. By changing position of the timing motor with respect to the cam follower through slots (L) the amount of total span through which cycling occurs may be finely adjusted, initial span range is made by the displacement cut into the cam. The speed of rotation of the cam and the number of cycles cut into the cam will determine the time cycle.

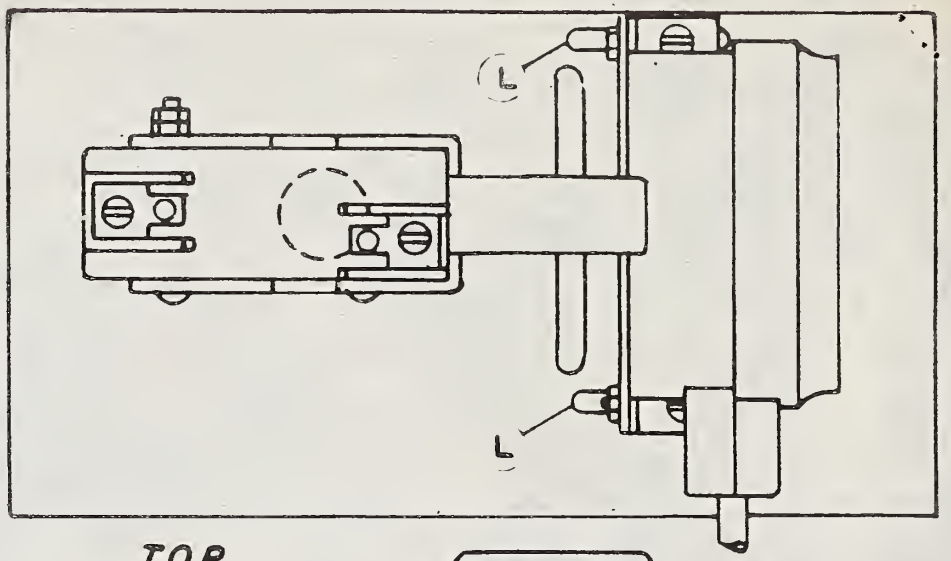
If desired, the thermal movement may be imparted to the switch body with the cam making contact with the switch plunger. Or the switch may be rigidly mounted and the thermal element used to raise and lower a pivoted motor and cam arrangement which in turn would make contact with the switch plunger. Practically any type of thermostat sensing element, including remote types with capillary tubes, may be used. And, finally, this same principle may be used for purposes other than temperature control as the thermal expansion unit may be replaced with any other sensing device that exerts enough pressure to close a set of switch contacts.

Controllers using mercury switches and regular brooder wafer thermal sensing elements have more recently been tried. By using shorter time cycles, about 5 seconds per cycle, the filaments of the infrared lamps do not have time to cool to ambient temperature, thus reducing the inrush current to the lamps, which in turn prolongs switch life. By using non synchronous motors, with more power, it is possible to trip one or more mercury tubes rated at 60 amperes each.

# PROPORTIONAL TIME

# TEMPERATURE CONTROLLER

J. G. TAYLOR 1-31-53

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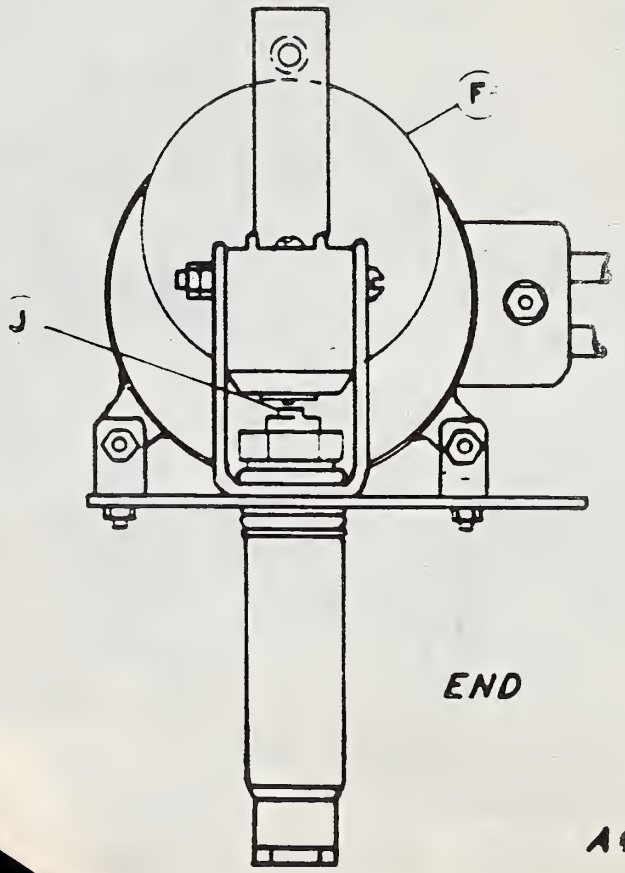


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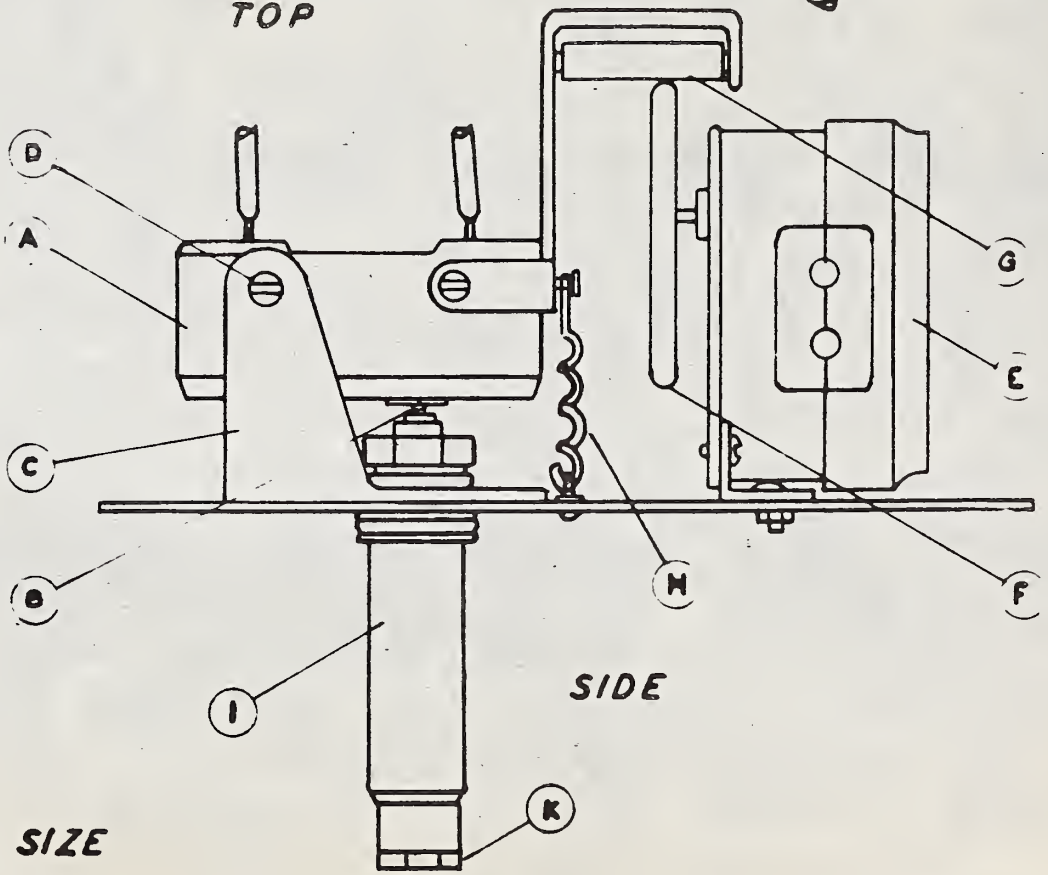


SIDE

ACTUAL SIZE